

Intercomparisons of OH Column Measurements from the Table Mountain Facility, Tokyo, and Fritz Peak Observatory for 1992 - 1998

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Outline:

- Description of TMF measurements
- Comparisons with Tokyo and FPO data
- Model sensitivity analysis
- Conclusions

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DOPPLER DETECTION OF HYDROXYL COLUMN ABUNDANCE

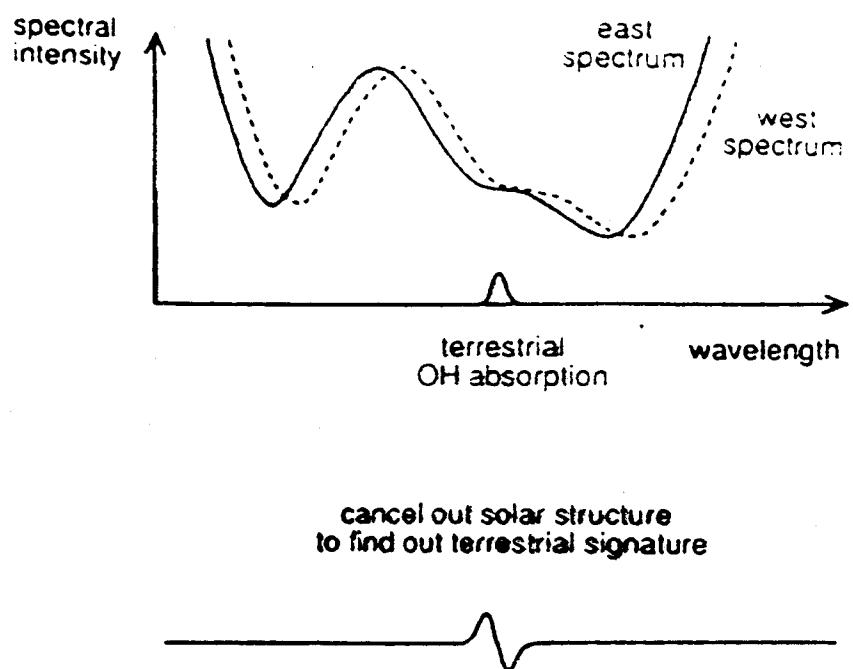
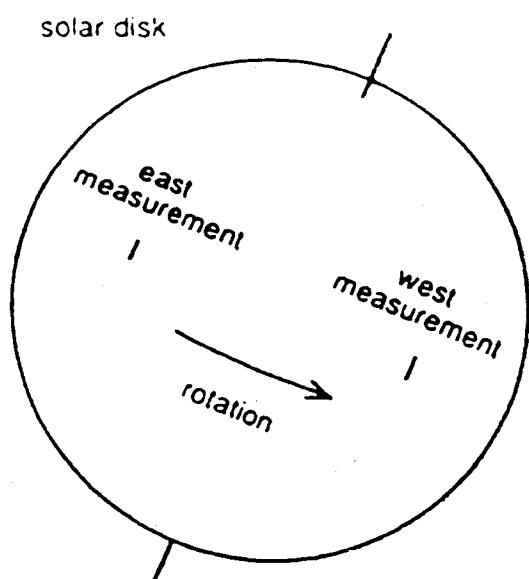
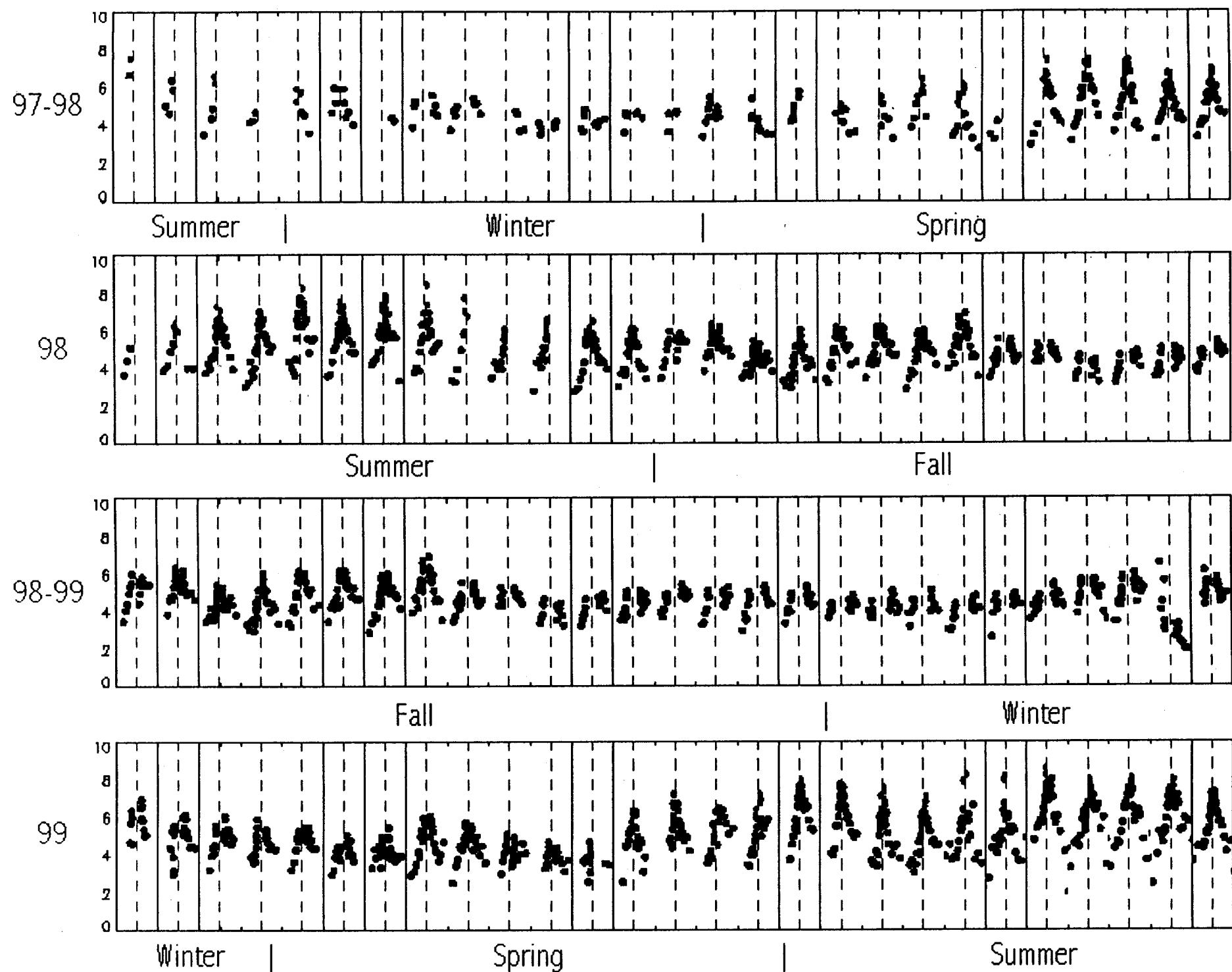


Fig. 1. Principle of the measurement to extract terrestrial absorption using Doppler shift of solar spectrum due to solar rotation.

Time Series for OH Column Abundance ($\times 10^{14}$ molecules cm^{-3}) from Table Mountain, CA



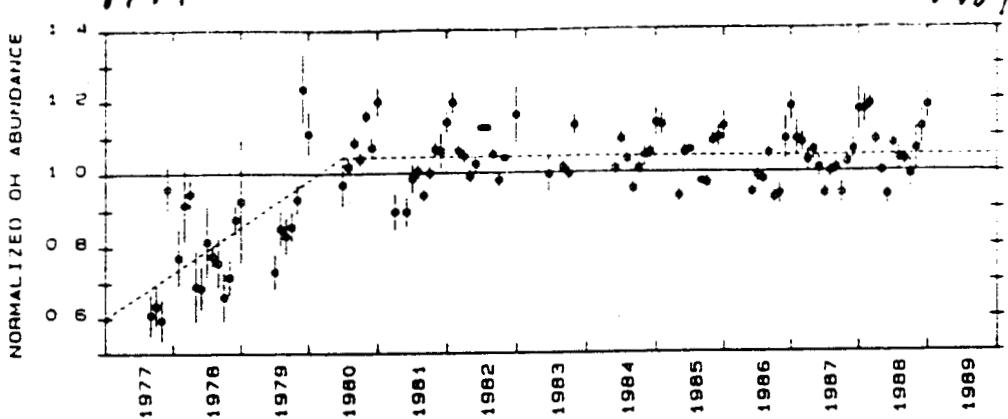


Fig. 2. Monthly averages of normalized OH abundances for 1977-1988. OH abundances have been normalized as described in the text. The dashed line shows the approximately linear OH abundance increase from 1977 through 1979 and the subsequent constant average OH level since 1980. The rms variation of normalized OH abundances about the dashed line is 0.085. (Burnett et al. 1989)

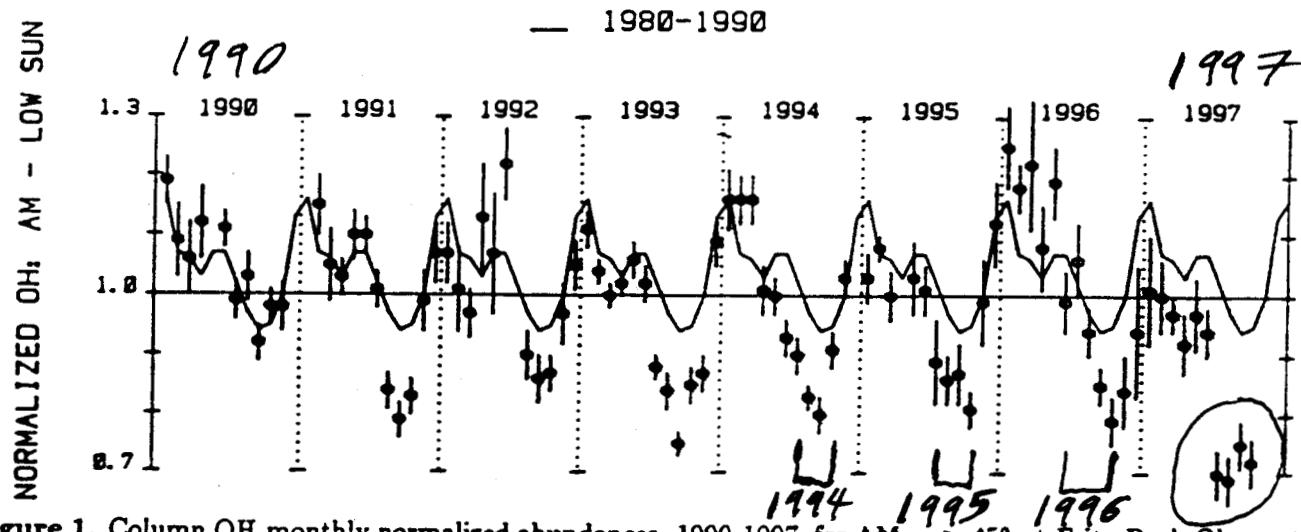


Figure 1. Column OH monthly normalized abundances, 1990-1997, for AM, $\chi > 45^\circ$ at Fritz Peak Observatory, Colorado. Normalization is with respect to the annual average AM solar zenith angle dependence for 1980-1990. Error bars are standard error of the mean. The solid curve is the average seasonal behavior of similar data for 1980-1990. (Burnett & Minschwaner 1998)

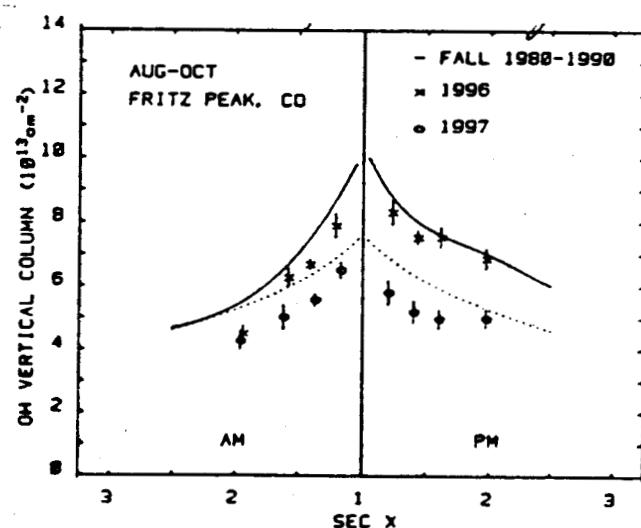


Figure 2. Column OH abundances at Fritz Peak for August-October, 1996 and 1997, versus secant of the solar zenith angle. Error bars are the standard error of the mean. The solid curve is the average of observations for August-October 1980-1990. The dotted curve shows model values using photochemistry with pre-1980 chlorine levels [Burnett and Burnett, 1995]. (Burnett & Minschwaner 1998)

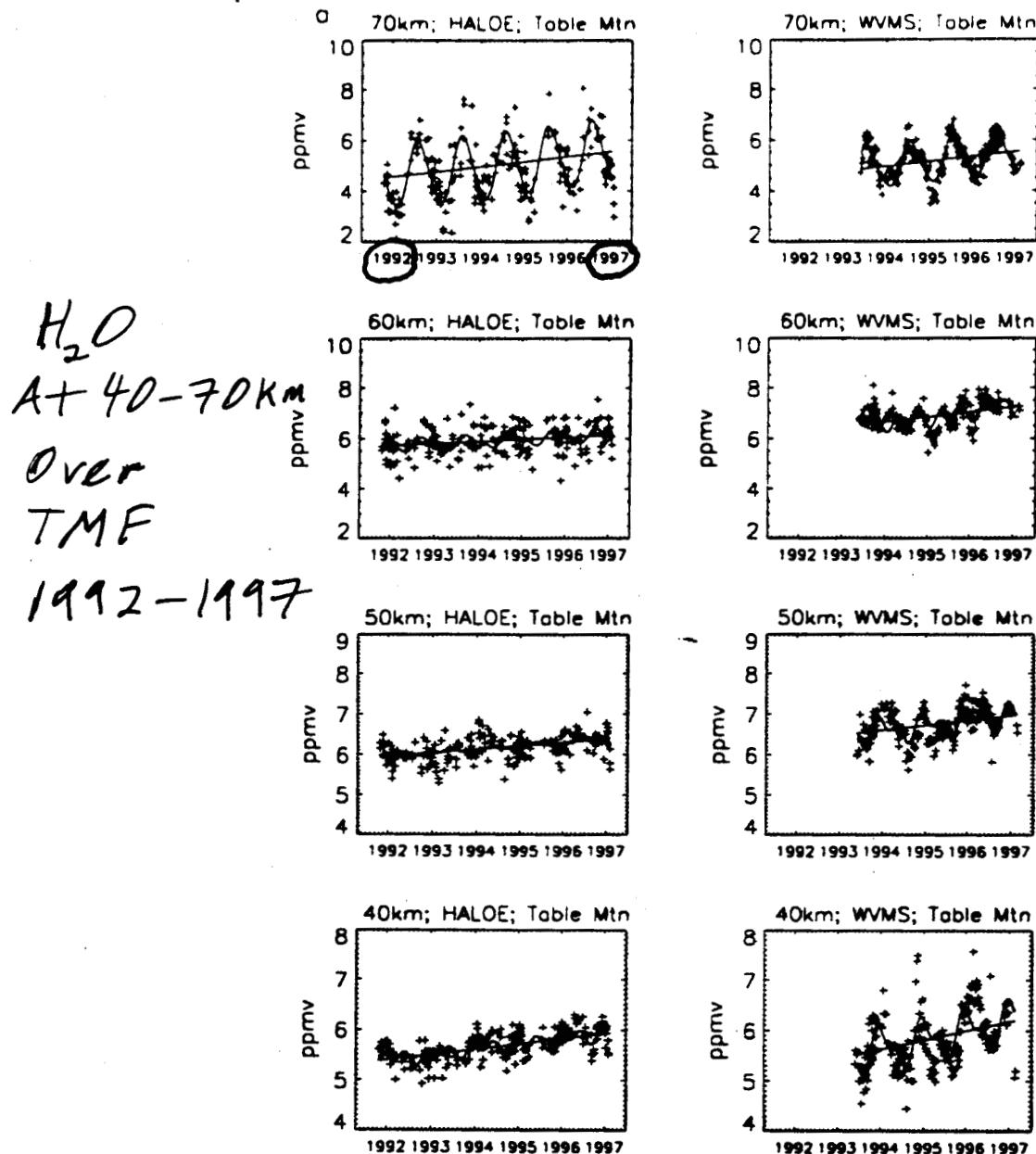
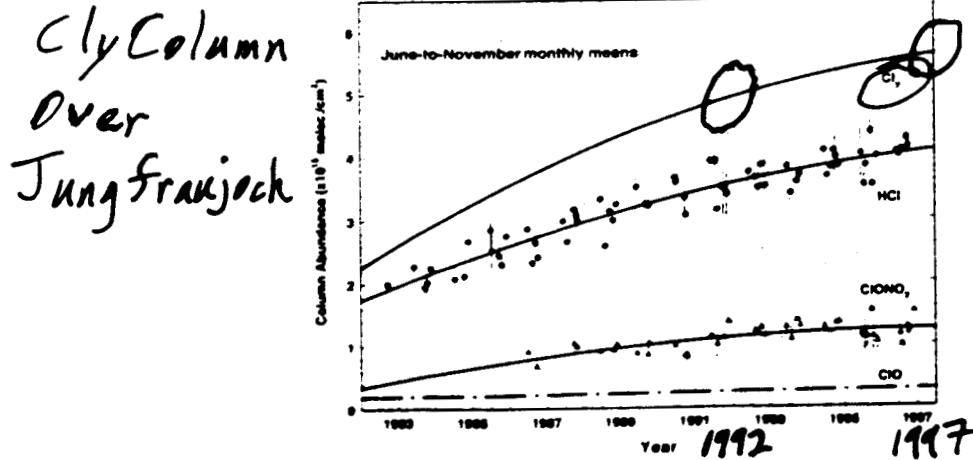
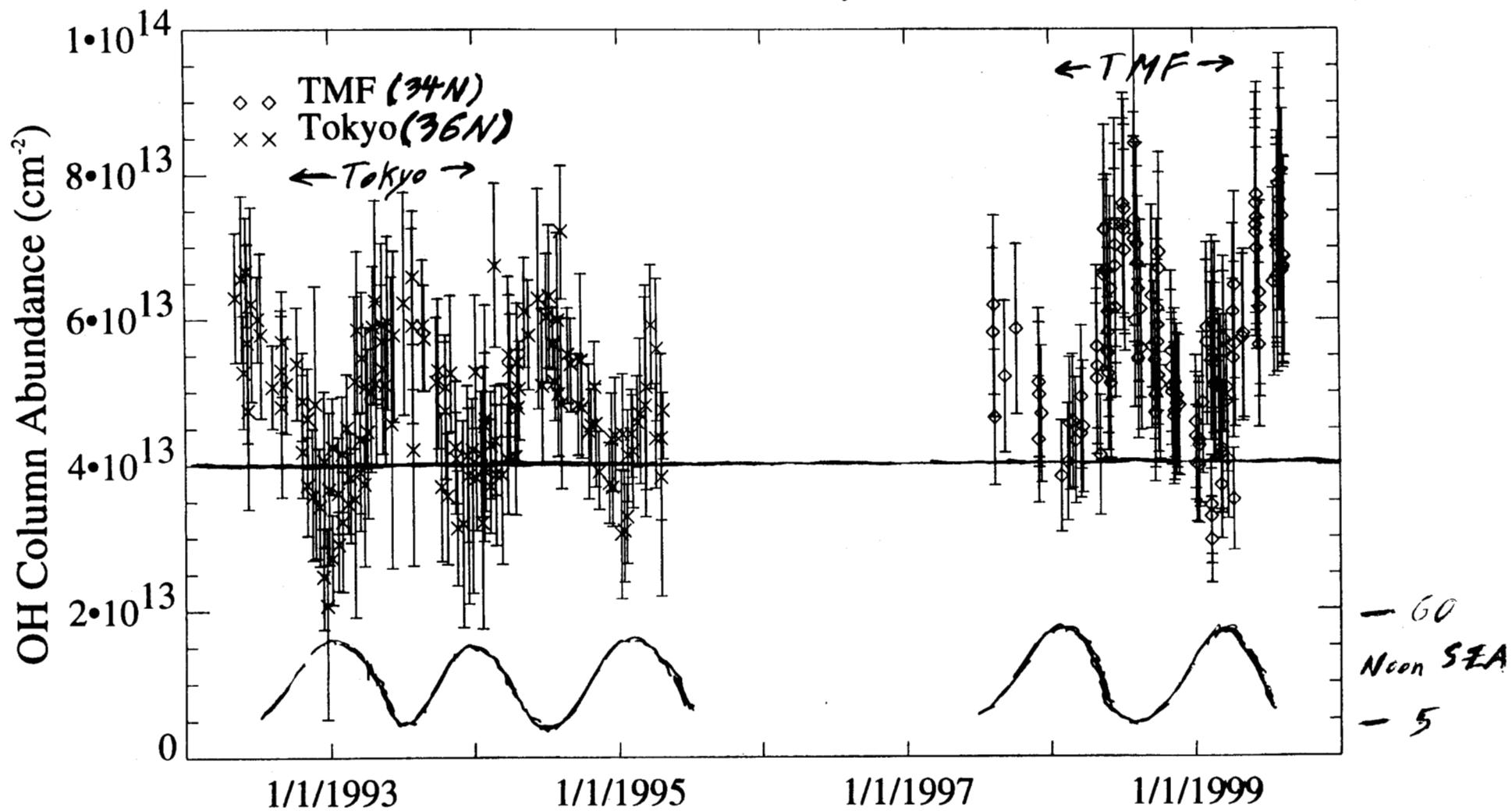


Figure 5a. Retrievals at selected altitudes from WVMS measurements at Table Mountain and from collocated ($\pm 5^\circ$ latitude and $\pm 30^\circ$ longitude) HALOE measurements. The HALOE retrievals have been convolved with the WVMS averaging kernels using (2). Also shown is the fit from (3) and the trend component from this fit (a_{st}).
(Nedoluha et al. 1998)



Near Noon OH Column Over Tokyo and Table Mountain



Model Sensitivity Results for OH Abundances

<u>Parameter</u>	<u>Interannual Changes 1992-7</u>	<u>Expected OH Column Response</u>
Solar Flux	Min - Max	~ 10%
H ₂ O	< 25%	< 10 %
Surface Albedo	0 - 1	8%
CH ₄	< 25%	< 1%
NO _y	< 5 %	< 0.5%
Cl _y	~ 10%	< 0.25%
CO	< 5 %	< 0.1%

Model Description

Caltech/JPL 1-dim model for March at 30 N latitude

H₂O, H₂, N₂, O₂ profiles invariant, other species diurnally varying

JPL97 kinetic rates

O₂ SRB from updated Allen and Frederick 1982

Conclusions

Burnett and Minschwaner (1998) interpreted normalized early- to mid-morning OH column data from FPO as decreasing from 1991 to 1997
--with decrease throughout the day from 1996 to 1997 when averaged over Aug - Oct

Tokyo and TMF near-noon data show no clear trend from 1993 - 1998

Trends from the three data sets are not consistent but data that would permit a direct comparison are not available

Model sensitivity analyses based on observed changes in the mesosphere and stratosphere are consistent with the absence of a trend in OH column abundance.

--No trend is seen in the combined Tokyo and TMF measurements

Future Presentation

Model comparisons to TMF (and later Tokyo) column measurements for selected days throughout a seasonal cycle using data from TMF LIDAR, WVMS, HALOE, and MLS

Photochemical Model

Caltech/JPL 1-dim model (Allen et al. 1981)

Initialization:

Diurnally-averaged steady state from
May 1985 ATMOS 30N profiles
Solar flux from Mount & Rottman (1983)
and WMO (1981)

Calculation Mode:

Diurnally varying, no eddy diffusion
Diurnal repetition of OH at 25-80 km to 1%
 H_2O , H_2 , N_2 , O_2 profiles invariant

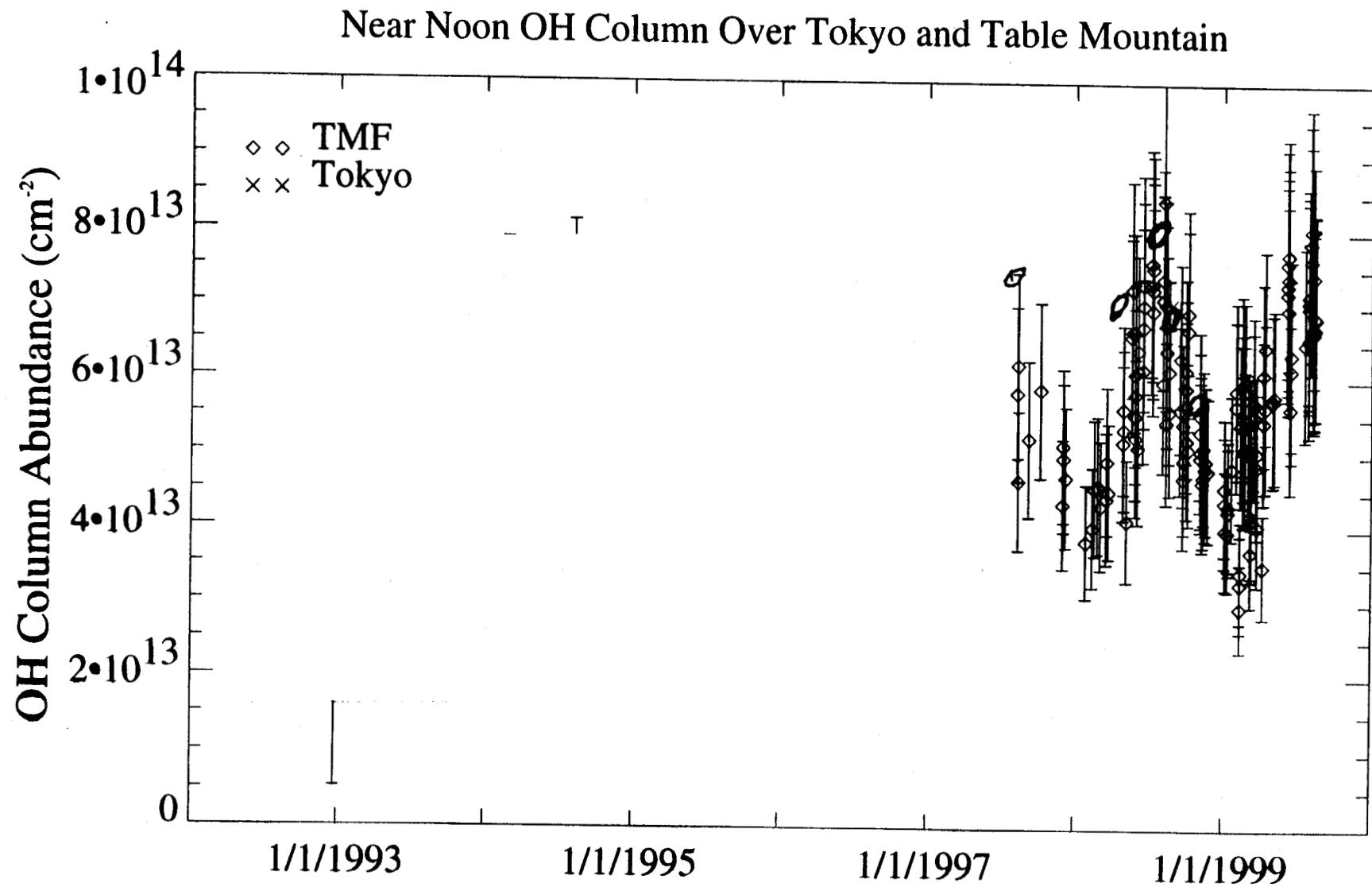
Chemistry and Parameterizations:

JPL97 kinetic rates
 O_2 SRB from Allen and Frederick 1982 as
updated by Froidevaux et al. 1985

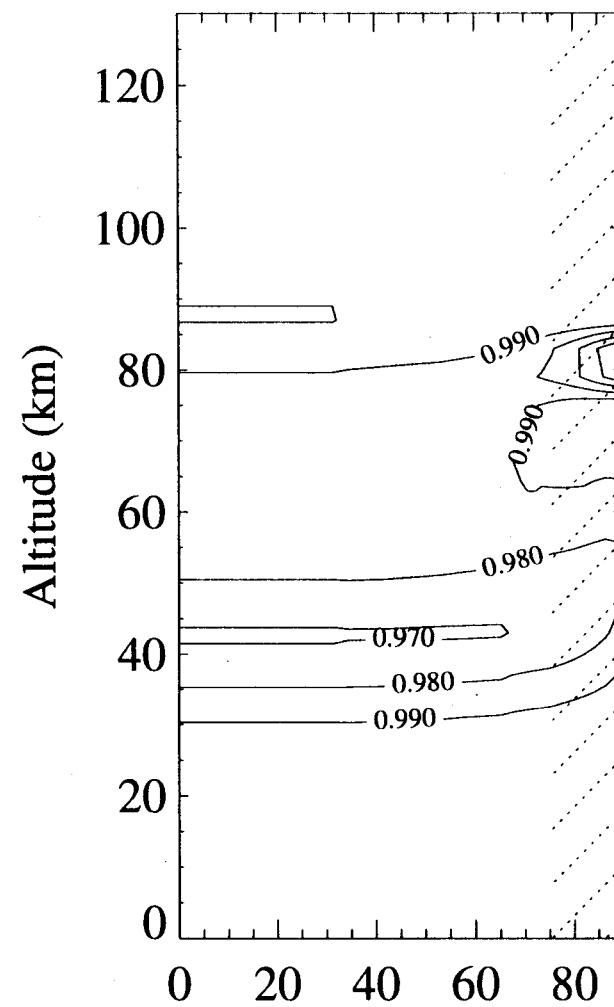
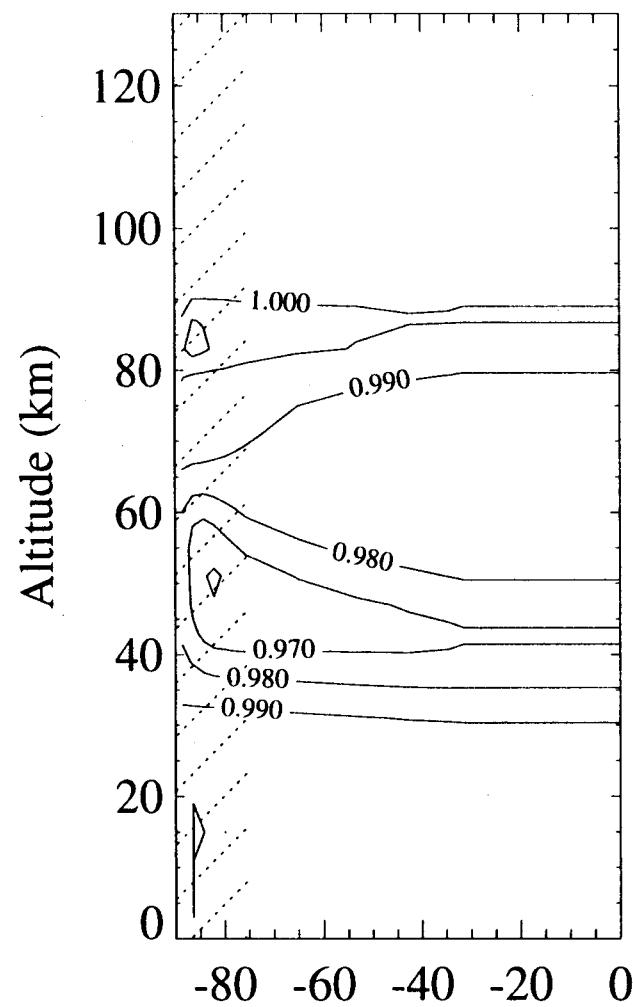
Sensitivity analyses done for March at 30 N

Comparisons to TMF measurements used:

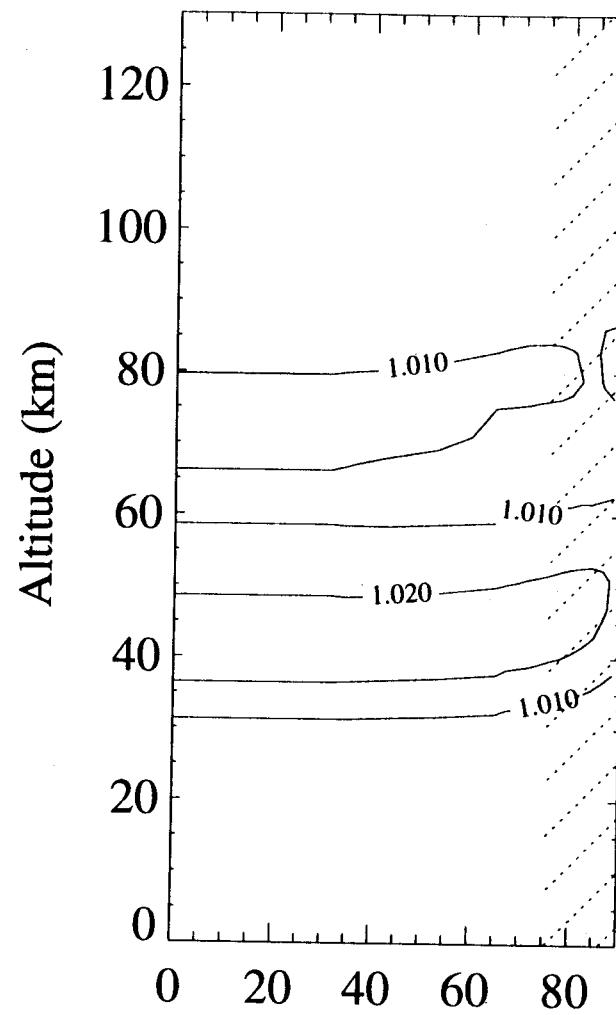
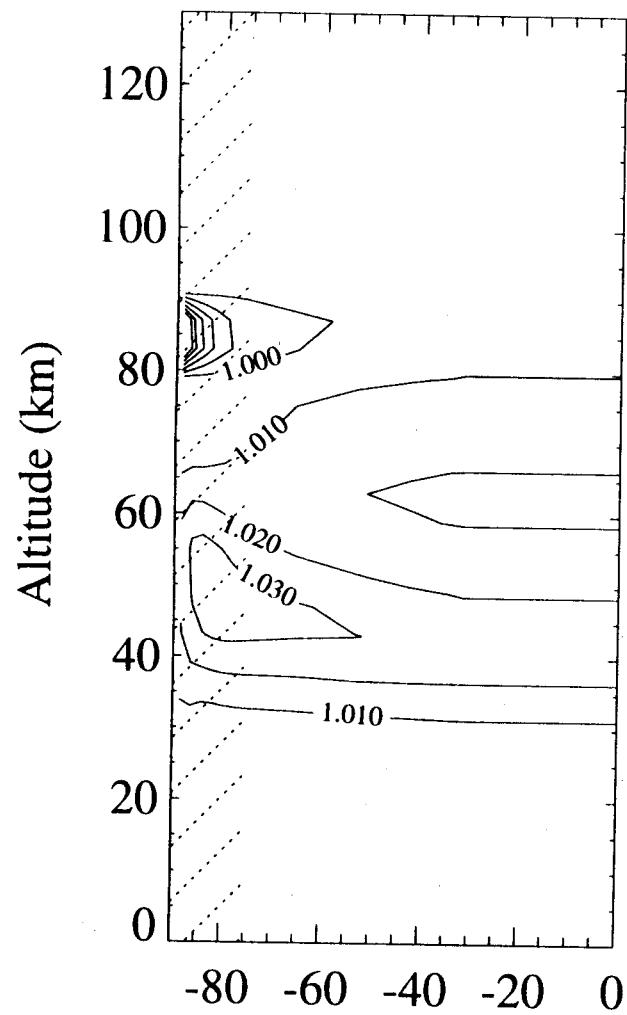
H_2O from HALOE v19 near TMF
 Cl_y scaled from 1985 per WMO 1998



OH converged over diurnal cycle to 0.0100000 for 25.0000 - 80.0000 km altitude
Fractional change of OH column for changing H₂O to 0.750000 of nominal in 8 km region centered at altitude



OH converged over diurnal cycle to 0.0100000 for 25.0000 - 80.0000 km altitude
Fractional change of OH column for changing H₂O to 1.25000 of nominal in 8 km region centered at altitude



(Shaded regions not presently observable at TMF)

